August 2006

Proceedings of 8th Bird Strike Committee USA/Canada Annual Meeting: 21-24 August 2006

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21-24 August 2006

St. Louis, Missouri USA

(www.birdstrike.org)

ABSTRACTS

(1) REDUCTION OF RISK: A FLIGHT CREW GUIDE TO THE AVOIDANCE AND MITIGATION OF WILDLIFE STRIKES TO AIRCRAFT

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Each year the world's airlines lose between $1 billion to $2 billion due to wildlife strikes to aircraft. This is roughly the same level of loss as the carriers pay out each year for lost luggage. One US airline cites its losses at $2 million a month due to engine ingestion alone. The last several years have seen both hull losses to air carrier aircraft and lesser damage caused by such actions as loss of control and runway excursions. Wildlife strike mitigation is a defense in depth: airplane certification/construction standards; action by airport operators to minimize wildlife on and around airports; standards/regulation development by authorities such as ICAO and national regulators. What is missing is affirmative action by airline operators to develop and implement policy which will aid in the mitigation of this risk. As the airline operator, through its employees, is on the tip of the spear with this hazard, sound avoidance and mitigation policies, detailing actions which may be taken by employees, should be implemented. This paper will detail common practices which will reduce/eliminate wildlife strikes or mitigate their impact.

(2) INTERNATIONAL BIRDSTRIKE COMMITTEE MINIMUM BEST PRACTICE STANDARDS FOR AERODROME BIRD CONTROL

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Despite almost 40 years of research effort and operational experience, there remains very limited consensus concerning the best methods for managing the bird strike hazard at aerodromes. This is, in part, because the levels of risk, habitat type and bird species present at different aerodromes varies and the precise techniques that are successful at one site may not work at another. It is also partly due to differences in the levels of resources available at different airports and to differences in the attitude of airport managers and national regulators to the hazard posed by bird strikes. Following the implementation of the new ICAO standards on airport bird control, IBSC agreed at the 26th meeting in Warsaw that a set of recommended minimum best practices should be developed to try and address these problems. The IBSC best practice guidance is now complete and endorsed by the membership. This paper describes the main features of what IBSC regards as the minimum level of bird control effort needed to effectively manage the bird strike risk at an airport.

(3) CHINA CIVIL AVIATION BIRDSTRIKE PREVENTION

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This article initially analyses the subject of bird strike of China civil aviation and introduces bird strike incidents in these years on quantity, damage, flight phase and height, season, time and other characters. Measures are subsequently presented which were taken by China civil aviation to reduce the hazard of bird strike and ensure aviation safety. First, regulations and advisory circular were issued to qualify and direct bird strike prevention at airports. Then, systematical research on bird strike prevention was done. Birdstrike Prevention Guidance Manual has been compiled to direct aerodrome, airlines, air traffic control and other agencies to cooperate on bird strike prevention. The book also directs personnel to conduct ecological environment investigation, identify dangerous birds and develop integrative bird strike prevention system at airports. Assessment Outline of Airport Wildlife Hazard Management was introduced to evaluate if effective measures had been taken at airports. Lastly, information system of bird strike prevention has been developed. Aves identification database provides several methods to identify birds and information of each birds' figure and ecological characteristics. Time of inhabitation, quantity, level of danger and other information also can be gotten. Airport Birdstrike Prevention Information System establishes database to record and forecast bird condition by zone, which provides a useful tool of recording, analysis, forecast and management for airport personnel. The bird strike incident report system collects and analyses the information of national bird strike incidents and shares these materials. Finally, the future work of China civil aviation is mentioned, including developing requirements and materials for personnel training, establishing evaluation index system of equipment and technique on bird strike prevention to evaluate its efficacy at airports, bird identification and research on night-active birds' detection and control, etc…

(4) REMOTE SENSING TECHNOLOGY AND GROUND-BASED OBSERVATIONS FOR EVALUATING A PROPOSED AIRPORT SITE IN CONWAY, ARKANSAS

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The city of Conway Arkansas has proposed a replacement for its existing airport with a larger, more modern facility. Site selection and architectural design began eleven years ago with a preferred location selected near the Arkansas River. After nearly completing the architectural plans for construction, preliminary approval was granted from the FAA regional office pending final coordination from their headquarters. The FAA asked their Staff Wildlife Biologist to evaluate and endorse the proposed location. Concerns over local land uses and the proximity to a potential major flyway led the FAA to withhold support for the site pending further study. The city would need to demonstrate that potential bird and other wildlife hazards at the location did not exceed background levels in the region, though there is no standard method to do so. Preliminary ground-based observations by a consultant seemed to support the claims by local experts that birds did not present hazards warranting selection of a new site. The FAA requested and funded an extensive study to determine if these preliminary results could be further supported by more scientific analyses. Use of NEXRAD radar data and the US Bird Avoidance Model supported the preliminary findings that birds may not use the area as a major migratory path or in unusual local movements. A dedicated mobile bird detection radar was installed at the site and sample ground-based observations were conducted to monitor the location around-the-clock for a full year. Results indicated that the site did not exceed and frequently had less bird activity than other potential locations in a large area surrounding the city. The FAA Staff Wildlife Biologist's recommendation will be based partly on these findings. The significance of this project is that for the first time, remote sensing technology combined with ground-based data collection methodology were used to comparatively quantify the potential bird hazards in an airport site selection process. Such projects may become a benchmark for other proposed actions and help clarify ill-defined standards for proponents of new airports or airport expansion projects seeking to meet FAA requirements.

(5) REMOTE SENSING OF BIRDS AROUND AIRPORTS – PRESENT EFFORTS IN GERMANY

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As birds around airports and military airfields are a potential danger for air traffic, there are ongoing efforts, also in Germany, to monitor birds in conflicting airspaces. Besides other factors the spatial scale very much determines system demands and the resolution of detections. Based on the well known time lapse photography technique, digital video recording of radar screens is still used in long term (e.g. 2 years) bird monitoring studies at German airports. The technical equipment is easily installed and the remote controlled systems are working very reliable. However, data analysis is time consuming and needs a good deal of expert knowledge. Currently the prototype of a new military two-dimensional airport surveillance radar is tested by the German Bundeswehr. Data processing of this primarily air traffic control radar also includes signal analysis for severe weather pattern and bird detection in real time. First results are promising. However, the newly available information on potential bird hazard cause so far unknown problems for air traffic controller. Mobile radar systems based on marine radar technology are relatively cheap and are an option for local bird movement studies and as sensors of real time warning systems at critical local areas. However calibration and validation is a significant problem. New remote controlled military infrared sensors are capable for high resolution and fairly long range (approx. 1 – 2 miles) bird observation. They allow to gather information on birds, even species, around an airfield during phases of flight and at rest throughout the day, limited by the temperature difference to the background. Combined with laser systems they also provide information on flight altitudes and positions. A research project at a German military airfield is presently conducted to test the accuracy of different sensors. Several systems and their setups are presented, their specific capabilities, advantages and limitations are outlined. How these techniques can be utilized to reduce bird strikes around airports will be indicated.

(6) DEVELOPING PROTOCOLS FOR BIRD STRIKE RADAR PERFORMANCE ASSESSMENT

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Over the past six years the Center of Excellence in Airport Technology (CEAT) has been supporting Federal Aviation Administration research in aircraft and airport safety. CEAT has conducted reviews of bird strike sensor technology, and has led validation testing of a radar developed specifically for bird detection at airports. This experience, which includes development of quality assurance plans and field validation of radar capabilities has led to the development of protocols for bird strike radar performance assessment. The protocols to be reviewed are based on a request made to bird radar vendors that asked for information in three areas: 1) A power gains and losses budget that is a flow chart of power change through the sensor system; 2) A listing of performance specifications that provides documented results of testing that provides performance specifications/expectations for the sensor system with either wildlife targets or known or reference targets; and 3) A detailed description of data provided by the radar, including the capacity for remote operation of the system. In addition, CEAT prepared a listing of information required for a comprehensive performance assessments that included information on radar components and the characteristics of remote operation including the cyber infrastructure needed to support effective use of radar data in the airport environment, including both data and metadata. The protocol developed will be reviewed with the objective of identifying critical information needs and the comprehensive technical and data analysis and management issues in assessing radar performance. Performance will also be reviewed in light of radar performance needs identified in consultation with airport wildlife management personnel.

(7) IMPLEMENTATION AND DISTRIBUTION OF BIRD DETECTION RADAR AND BIRD HAZARD ADVISORY INFORMATION FOR MILITARY AND COMMERCIAL AVIATION

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Over the past five years, development of mobile bird detection radars for use as real-time aircraft bird strike avoidance systems has moved from research and development into active deployment as an operational technology. The MERLIN™ bird detection radar, with an update rate as frequent as once per second, is currently deployed as production-model technology with 15 systems operating in the U.S., Canada, Scotland, England and The Netherlands. Deployment challenges over the past two years have included "how" and "in what forms" to deliver the real-time and near real-time information to controllers, wildlife control units, pilots and decision makers so that bird hazards can be more reliably detected, strike risk reduced, bird control efficiency increased, and to develop detailed historical resource databases to support long-term management actions. MERLIN systems are currently being used in civil, military and landfill environments using wide-area wireless distribution of data displays and products in real-time direct to airfield operations, planners and bird control units. On-going operating experience is helping to define specific concepts-of-operations (CONOPS) for each type of environment as to how the technology can be used and how and in what form bird radar information is integrated into current operational risk management and flight safety programs.

(8) LESSONS LEARNT FROM AVIAN RADAR TRIAL AT TORONTO PEARSON INTERNATIONAL AIRPORT

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The paper reports on lessons learnt from an avian radar trial conducted at Toronto Pearson International Airport in November 2005. Toronto Pearson International Airport is Canada's largest airport and has unique requirements due to its proximity to metropolitan Toronto, a major urban center. The paper begins with an assessment of desirable application requirements that take into account current wildlife management practices. Application requirements include early warning of birds approaching the airfield; real-time tracking of birds and aircraft, rapid review of overnight bird movements to identify bird stopovers, and integration into wildlife management operations. Next, the paper examines special radar design requirements at large airports like Toronto Pearson International. The presence of multiple runways and the large airfield lead to a requirement for multiple radars. This in turn leads to a radar system solution that includes multi-sensor fusion which places significant demands on real-time tracking and target data distribution. Restrictions on the sighting and operation of radars lead to radar engineering trade-offs. These include trading off the best location and height for the antennas used and their types to minimize blockage, maximize coverage, minimize interference and control clutter. Finally, the proximity of dense urban vehicular traffic in vicinity of airport leads to specialized processing requirements to manage vehicular clutter while not compromising bird tracking performance. The paper includes photographs and real radar data to convey the issues and the lessons learnt.

(9) THE USE OF RADAR TO AUGMENT VISUAL OBSERVATIONS IN WILDLIFE HAZARD ASSESMENTS

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Assessing wildlife hazards to aviation in the airport environment is typically initiated by conducting a Wildlife Hazard Assessment (WHA). Ecological relationships between wildlife populations and habitat are usually discerned through observations during the course of one annual cycle. Although proximate hazards, on the airport, are well defined during the WHA process, off-airport features also can attract wildlife. Wildlife species can transit airport property traveling to and from habitat attractants. During a WHA, common wildlife sampling techniques are employed to determine species, their approximate numbers, and through association an index of potentially attractive habitat. Continuous observations could provide a more complete picture but would require greater sampling effort. Radar is a tool that has demonstrated efficacy to automatically monitor wildlife at greater distances than can be achieved through traditional techniques. Modern systems also have the ability to record a variety of spatial and temporal variables simultaneously and processed data streams can be further analyzed. In association with GIS software, these data can be queried to provide hazard and risk mapping on the airfield and in the approach/departure corridors, as well as the air traffic pattern. The use of radar in combination with traditional wildlife observation techniques could significantly increase the amount of information available for analyses during a WHA. At MCAS Cherry Point we used radar observations to document winter waterfowl movements at night (including migration departures) as well as diurnal bird movements. These movements included incursions into the approach/departure corridors and the initial location of the waterfowl presenting the hazard. Although radar has its benefits, such as detecting wildlife at night and greater distances than can be accomplished visually, it also has its shortcomings. These include reduced sensitivity during heavy precipitation (e.g., X- and K-band radars) and the inability to identify the species of the birds detected.

(10) AN ACOUSTIC / RADAR SYSTEM FOR AUTOMATED DETECTION, LOCALIZATION, AND CLASSIFICATION OF BIRDS IN THE VICINITY OF AIRFIELDS

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Bird-aircraft collisions present a significant threat to military and commercial aircraft, and as bird populations and air traffic continue to grow, and airport/airbase operations continue to expand, the problem will steadily get worse. To help mitigate bird strike hazards, we propose a multi-sensor system consisting of ground radar and acoustic sensors that can directly monitor bird activity and provide an alert when a threat condition occurs. Radar offers a large detection range and the ability to detect in all weather conditions, while acoustic sensors allow the ability to detect targets in the midst of clutter and add the capability to classify. A multi-sensor approach ensures that the system can provide bird strike monitoring capability in any situation with a low false alarm rate. As the Phase II effort of an Air Force STTR project, we have constructed and tested a microphone array adapted from state-of-the-art undersea warfare sensor technology that measures accurate angles to any acoustic source (broadband or narrowband) and a parabolic dish microphone which provides high-gain data on targets of interest. A test was conducted near Panama City / Bay County International Airport in conjunction with the Merlin Bird Detection Radar designed by DeTect, Inc. Results of this test will be presented and show that the acoustic array is capable of detecting, localizing in angle, and tracking multiple targets simultaneously, including birds, bats, aircraft, automobiles, people, and boats. The parabolic dish microphone was able to provide very high-gain acoustic data on several of these targets. The radar data was used as truth data for acoustic sensor performance evaluation and to determine situations in which the acoustic data can benefit the radar. Altogether, almost three days of continuous acoustic and radar data were collected, and analysis of these data show that the hybrid radar-acoustic system can provide bird strike avoidance capability.

(11) THE AIRPORT IS NOT A WILDLIFE REFUGE!

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Airports must eliminate or minimize bird and other wildlife attractants to maintain safe operating conditions. Unfortunately, all too often this is not the case. Outside pressure, political or economic decisions, and lack of awareness of appropriate management practices lead to many airports becoming safe havens for wildlife by accident or incredibly, by design. Airport tenants, airlines, or other users are often at the mercy of the airport operator or owner and believe they have little control over the situation where they operate. Proper habitat management is the basis for any wildlife or bird strike reduction program. Vegetation management is at the core of all successful programs. Turf management following FAA guidelines or DOD directives are clearly defined, but often ignored for various reasons including perceived savings, aesthetics, or confusing information regarding single-species preferences or unique specific sites. Wetlands mitigation projects are still conducted on airport sites despite recent new agreements between several federal agencies that specifically address the resolution of such issues. Agriculture is still practiced on many airfields despite FAA guidelines to the contrary. Threatened and endangered species are actively promoted on numerous airports due to perceived "requirements" levied by state and federal governments. We offer many examples of both habitat mismanagement and proper practices on airports from across the country. Recommendations and examples for treatment in a variety of situations are provided, including FAA and DOD requirements and guidelines for such situations.

(12) DISPOSAL OF BIO-SOLIDS AT AIRPORTS: INCREASED WILDLIFE HAZARDS TO AVIATION OR NOT?

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Airports often times employ different land uses on their airfields to generate or save funds. The application of bio-solids is one such use. Questions concerning this practice and its compatibility with safe aircraft operations arise; however, little information exists concerning this issue. FAA regulations and technical guidance do not currently prohibit this practice on airfields. Marine Corps Air Station Cherry Point, located in North Carolina, has applied treated bio-solids to portions of the airfield over the past 14 years; this program is anticipated to continue into the future. During 2003–2005, we conducted a study to compare plant community dynamics and wildlife use of grassland habitats related to bio-solids application. Airfield plant communities have been significantly altered by long-term bio-solids application. Grasslands where bio-solids were applied were dominated by tall fescue and bahiagrass, whereas plant species diversity was higher in control plots. Overall, bird use of plots appeared to be species-specific and was accented by seasonal differences. During winter months, observations of European starlings, eastern meadowlarks and other flocking birds increased in bio-solid plots relative to control plots. A total of 5 small mammals were captured over 4,000 trap-nights, indicating small mammal populations were similar between grassland areas. Patterns of white-tailed deer use of bio-solid and control plots were spurious; areas of higher deer use were most likely related to other habitat features (e.g., travel corridors). The bio-solids application program does not appear to have created a long-term wildlife attractant. Short-term and seasonal wildlife hazards that might occur can be mitigated through a proactive BASH management program.

(13) POTENTIAL WILDLIFE CONTROL THROUGH USE OF A PLANT GROWTH REGULATOR

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Habitat management techniques that reduce wildlife use of habitats on and around airports are critical for safe airport operations. Herbaceous vegetation comprises the main habitat type at airports and vegetation can be managed by various methods. The objective of this study was to compare bird and mammal use of grassland habitat managed either by mechanical (mowing) or chemical (plant growth regulator) methods. We monitored vegetation growth, plant community composition, and wildlife activity each week during May – October 2003 in study plots located in Erie County, Ohio. Vegetation was taller ($P < 0.01$) and denser ($P < 0.01$) in unmanaged plots than in managed (mowed or growth regulator) plots. Plots sprayed with growth regulator had lower forb/legume cover and higher grass cover than unmanaged or mowed plots. We observed more ($P < 0.001$) birds ($\bar{\times} \pm$ SE) per 5-minute survey on the ground in or perched on vegetation in unmanaged (3.0 ± 0.3) than mowed (1.5 ± 0.2) or growth regulator (1.5 ± 0.3) plots. More ($P < 0.001$) white-tailed deer were observed in mowed plots (4.3 ± 0.5) than either unmanaged (2.2 ± 0.6) or growth regulator (1.6 ± 0.3) plots. Fifteen small animals were captured in control plots, whereas no animals were captured in managed plots. Applying plant growth regulator did not maintain desired vegetation height and thus is not a cost-effective alternative to mowing in plant communities of mixed composition. Managing vegetation height reduced wildlife use of grassland habitats. Removal of forbs and legumes by the growth regulator might explain the reduction in deer use in these plots. Reducing forbs and legumes might also make grasslands less attractive to small mammals. By simplifying herbaceous communities and encouraging plants less desirable to wildlife, it may be possible to reduce the attractiveness of airfields to wildlife species hazardous to aviation.

(14) CATTLE GRAZING AS PART OF AN INTEGRATED MANAGEMENT PROGRAM TO REDUCE WILDLIFE HAZARDS AT KANSAS CITY INTERNATIONAL AIRPORT

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Opening in 1972, the Kansas City International Airport (MCI) has had numerous issues concerning white-tailed deer. The first documented deer strikes at MCI were in 1979 and 1980. Between 1996 and 2000, airport operations entered 39 reports of deer inside the fence on the AOA, or 0.72 deer incursions per month, and 28 instances where deer were struck by vehicles on airport property. In one situation, a deer entered the airport terminal by breaking through a large glass window and injured three people. After a Wildlife Hazard Assessment was completed in 1997, Wildlife Services and MCI worked together closely to make several habitat modifications to the airport. Deer surveys during spring 2000 estimated 60 deer per square mile along the perimeter of the AOA. During the summer of 2000, over 800 acres of expired CRP land, mostly fescue, and 400 acres of brome grass, converted from grain production, was placed into a managed cattle grazing program. Over 9 miles of new fence was installed around these pastures that directly border the AOA. Other habitat modifications included removing over 50 acres of wooded tracts that border the AOA. After these modifications were incorporated, deer control was implemented beginning in January 2001. From 2001 to present, air operations entered only 12 reports of deer inside the fence, an 81% reduction compared to 1996-2000, and perimeter deer surveys conducted in fall 2005 estimated 25.5 deer per square mile, a 58% reduction. Although FAA AC 5200-33A section 2-6a discourages livestock grazing on airport property, this specific livestock program has proved beneficial in reducing the attractiveness of the site to deer and other hazardous species. The program has provided income for MCI, prevented 1,200 acres of land from being used for grain production, and allowed cattle to naturally reduce wildlife habitat. No cattle have entered into the AOA.

(15) PREY MANIPULATION AS A MANAGEMENT STRATEGY AT AN INLAND SOUTH AFRICAN AIRPORT

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Prey manipulation was investigated as a means of reducing the bird hazard at the Bloemfontein airport, central South Africa. From January 1985 to December 2005 approximately 7,000 individuals representing 55 bird species which, potentially, posed a threat to aviation, were collected at the airport. Numerically the crowned plover (Vanellus coronatus), blacksmith plover (V. armatus), lesser kestrel (Falco naumanni), white-winged korhaan (Eupodotis afraoides) and double-banded courser (Smutsornis africanus) in order of importance constituted more than 90% of the total sample. Based on stomach analyses harvester termites (Hodotermes mossambicus) comprise the dominant food source of all five species concerned. Experimentally a significant and sustainable decrease in termite numbers and activities in disturbed grass areas could be accomplished by administering bait treated with Gaucho, a systemic insecticide. By using a combination of pitfall traps, mouse traps and sweep nets over a period of 15 months, prey abundance in undisturbed long grass (average 57 cm) and grass which were kept permanently short (average 22 cm) by regular mowing was compared. Terrestrial invertebrates, mainly insects, contributed more than 90% of the overall sample with twice as many individuals in short grass than in long grass. The available food source for the predominantly insectivorous avifauna at the Bloemfontein airport can thus be effectively reduced by implementing a so-called long grass policy in combination with seasonal chemical control of harvester termites, thereby limiting bird numbers and also bird strikes.

(16) BIRD USE OF STORMWATER MANAGEMENT PONDS: DESIGN CONSIDERATIONS RELATIVE TO DECREASING STRIKES WITH AIRCRAFT

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Airports must control the movement of storm water away from runways, taxiways, and aprons to insure the safety of aircraft operations. The U.S. Federal Aviation Administration recommends that such runoff be held for short periods, by use of detention ponds, so as to reduce use by wildlife (Advisory Circular No: 150/5200-33A; *Hazardous Wildlife Attractants On or Near Airports*). The purpose of our study was to quantify factors that potentially attract avian wildlife to stormwater management ponds so as to more efficiently direct resources toward management of hazards to aviation posed by these habitats, and provide critical input on the design of future stormwater-management structures. We are currently in the analysis phase relative to avian-use data collected weekly from 30 stormwater-management ponds in Washington near Seattle-Tacoma International Airport between 14 February 2005 and 17 February 2006. We are testing 2 primary hypotheses concerning avian use of these stormwater management ponds: 1) avian guild richness is most directly related to pond isolation (ha of wetland resources within 1 km) and 2) guild richness is influenced most by the combination of the surface area of the pond/wetland complex, relative area of emergent vegetation, and pond isolation. Here, we report our initial findings relative to model development, avian use of our 30 sample ponds, and potential implications for stormwater management at airports. Effective and economic management to reduce wildlife hazards at airport detention ponds is dependent upon first identifying/quantifying and prioritizing the factors attracting wildlife, then directing appropriate resources toward those threats.

(17) THE IMPACTS OF HABITAT MANIPULATION ON THE RING-NECKED PHEASANT POPULATION AT CCK AIR FORCE BASE IN TAIWAN

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Ring-necked pheasant is an endemic subspecies of Taiwan. The main habitat of the bird is the grass lands at the low elevation in Taiwan. The population has been threatened due to the fast agricultural development and human disturbance at their habitats in Taiwan. However, the airfield of CCK Air Force Base has maintained a healthy pheasant population due to the large scale of grass lands without much human disturbances. Several bird strikes occurred at CCK air force base due to the foraging activities of ring-necked pheasant across the runway of the airfield. The main purpose of this study is to identify the space distribution of the bird at CCK Air Force Base and evaluate the impact of habitat .manipulation on the activities of ring-necked pheasant in order to design a bird strike proof measure for the airfield. We conducted an extensive avian distribution survey at CCK air force base from 2001 to 2003. A total of 208 pheasant was counted during the study period. Among them 102 were counted in 2001, 55 in 2002 and 103 in 2003. The low population observed in 2002 was due to the alteration of the habitat including tree cutting in 2002. The pheasant population recovered rapidly in 2003. Late spring is the most active season for the pheasant right after the breeding season. The grass mowing activities at CCK as well as the population activities of the ring-necked pheasant were monitored from March to December 2002. The pheasant population preferred the habitats along the open runway of the airfield to the habitats in the administrative areas. The grass mowing activities were classified as least, medium and high according to the intensity of the mowing frequency on the monthly basis. A transect line count method was used to monitored the population activity of the pheasant. Significantly higher population activities were found at the least grass mowing area than the medium and the intense mowing areas. Obviously the pheasant prefers a grass habitat with a certain height of grass for foraging and cover to avoid predation. Therefore, the grass management will play an important role on reducing the bird strike risk of ring-necked pheasant at CCK airfield.

(18) THE EFFECT OF HARASSMENT BY DOGS ON GROUND-NESTING BIRDS IN AIRFIELDS

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Ground-nesting birds like lapwings and sandpipers constitute a major hazard at airports. Preliminary observations with the Israeli Air Force showed that stone curlew (*Burhinu-soedicnemus*, (Burhinidea)) were involved in 33% of all bird strikes in 2003 at Hatzor Air Force base in central Israel, most of which occurred during the nesting season. The ultimate reduction of curlew populations near the runways is dependent upon understanding the effect of predation risks on the curlew nesting behavior. In theory, true predation and artificial predation should have the same effect on bird behavior. We studied the effect of egg collection vs. egg collection complemented with "predation" by Border collies to determine if the harassment by the dogs resulted in a higher or faster rate of abandonment of nests on airfields, by placing the disappearance of a ground-nesting bird's eggs into the context of predation. Harassment by Border collies on most other ground-nesting species actually avoids the entire problem associated by nesting on the airfield by quickly and effectively eliminating the presence of the ground-nesting species, precluding any nesting behavior in the first place. However, the limitations of the habitat of IAF airbases and the superb camouflaged nature of stone curlews result in the delayed discovery of nests on IAF airfields. The limitation a female curlew has on the number of eggs it can lay each season may ultimately have two contradictory results on nest abandonment. If the amount of eggs is small and fixed, harassment with dogs coupled with egg removal would be expected to yield a shorter nesting season. On the other hand, if the amount of eggs is high, harassment might actually increase the total number of clutches per nesting pair and prolong the nesting season (and hence the time spent on the airfield). We discovered that the amount of eggs female curlews can lay in a season is at least twice higher than reported in literature and varies tremendously between individuals. Nevertheless, harassed curlews abandoned nests at significantly higher rates compared with curlews that lost eggs by strict removal.

(19) OVERHEAD GRID LINE SYSTEMS TO EXCLUDE WATERFOWL FROM LARGE BODIES OF WATER

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The presence of birds at retention/detention basins on or adjacent to an airport increases the probability of experiencing a wildlife strike. Overhead gridline systems have proven effective for reducing the presence of birds on small water bodies. While there are several grid materials available to address bird hazards associated with small basins, the list of options decreases quickly as the distance to be spanned increases. The Michigan Wildlife Services program (WS) tested five types of grid material on three large detention basins to determine which materials could span up to 675 meters (2214.5 feet) without center supports. Additionally, the line material could not sag substantially, because of water fluctuations of up to 1.5 meters (5 feet) depending on the frequency and duration of rain events. If a line would touch the surface of the water, the surface tension would hold it in place until freeze-up. The material found to be superior in our tests, was a braided fishing line made of Spectra® called PowerPro. Grid lines were suspended in two directions on 30-meter (100 foot) spacing. Preliminary results show a notable reduction in bird usage by waterfowl and gulls.

(20) AIRPORT CANOPIES BECOME STARLING ROOSTS – TWO AIRPORT CASE STUDIES

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For aesthetic purposes and to protect passengers from weather, airports often construct glass canopies over roadways. These structures can provide roosting opportunities for large numbers of European starlings, which can pose a significant strike hazard to aircraft. Both Portland International Airport (Oregon) and Cleveland Hopkins International Airport (Ohio) have recently had to address this problem, using different methods to find an effective solution. Portland installed 200,000 square feet of exclusion netting in its large canopy structure while Cleveland Hopkins used a combination of tree removal and harassment to disperse their starling roost. These two cases demonstrate the importance of considering wildlife attractant features as an integral part of airport design.

(21) RESPONSE OF BIRDS TO AIRCRAFT LIGHTING: IMPLICATIONS FOR REDUCING BIRD-AIRCRAFT COLLISIONS

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Is there a means by which birds might better discern aircraft position and speed, so as to reduce collisions? Vision is a primary and highly developed sensory pathway in birds, and recent work has shown that light can be an effective tool as a repellent and, potentially, as an alert. Given that bird-aircraft collisions (hereafter referred to as bird strikes) cost the commercial aviation industry world-wide in excess of $1.28 billion annually (U.S. $), the incorporation of ecologically salient light cues into the design of aircraft-mounted lighting is one means by which airlines might reduce bird strikes. We will report current findings from a field trial involving an international airline company and 5 B737s monitored since 2004 relative to service hours, operational status of pulsed (0.75 Hz) vs. non-pulsed landing lights, and incidents of bird strikes. Importantly, this field trial involves aircraft in use commercially, seasonal aspects of routes and fluctuations in bird populations and activity, reports from the crews relative standard operating procedures, and reports of bird strikes. Data collected during 2004, prior to installation of a pulse-control system, indicate an average of 4 bird strikes per aircraft for the year. Following the same aircraft into 2005 and prior to installation of pulse-control systems, the test fleet experienced 3.2 strikes per aircraft. However, after installation of pulse-control systems, the airline reported an average of 2.2 bird strikes per aircraft when the pulse system was not in operation, and 1.0 bird strike per aircraft when the pulse system was in use. In addition to aspects of this field trial, we will review a series of on-going experiments, concurrent with the field trial, which involve the exploitation of avian response to light (wavelength, color, pulse frequency) and vehicle movement, our initial findings, and objectives of upcoming research.

(22) USING BIRD STRIKE DATA TO MONITOR BIRD-HAZARD CONTROL

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An effective definition of a bird strike is the basis for quantifying the scale of bird hazard problems. Here we present a working definition of a bird strike, which in turn forms the basis of an analysis of 32 years' data collected at Dublin Airport, Ireland. A variety of datasets are analysed including the number of bird strikes per ten thousand aircraft movements, the mass of the bird species being struck, the time of year at which bird strikes occur and the dimensions of the aircraft utilising the airfield. In addition, we have analysed the mean number of strikes per year and the mean number of birds struck per bird strike. Following a very serious incident involving a Boeing 737-200 which struck a flock of gulls in the mid -1980's, a new regime of control measures was put in place. Therefore our study permits us to evaluate the effectiveness of this management programme. The results suggest that the most significant impact of control measures is to reduce the number of birds being struck per bird strike.

(23) BIRDS COMMUTING ACROSS THE RUNWAY: HOW TO REDUCE THIS BIRD STRIKE RISK?

***Albert de Hoon**, Royal Netherlands Air Force; **Luit Buurma**, Military Aviation Authority, The Netherlands*

Not only birds residing at airports, but also birds commuting daily across the runways from and to places outside the airport boundaries, may pose a threat to departing and landing aircraft. Species such as gulls, geese, cormorants, ducks, flamingos, starlings and crows often have foraging sites that can be miles away from their breeding or roosting places. Dealing with those commuting birds that pass over airports on a daily basis is complicated because their roosting, breeding, and foraging sites do not belong to the airport's property. The solution to the problem becomes even more complex when these sites are part of protected nature areas; local, national, and international laws increasingly require states to protect birds and their habitats. Airport authorities are caught in a dilemma because recently (2003) enacted standards by the International Civil Aviation Organization (ICAO) require that "the appropriate authority shall take action to decrease the number of birds ... by adopting measures for discouraging their presence on, or in the vicinity of, an aerodrome" and "any such other source attracting bird activity on, or in the vicinity of, an aerodrome shall be eliminated or their establishment prevented…". How can airport authorities deal with these conflicting regulations and mitigate hazards caused by commuting birds to departing and arriving aircraft? Different approaches for current and future situations at various airports throughout the world, ranging from shooting the commuting birds as they cross the airport boundary to adjusting flight schedules of aircraft, will be discussed.

(24) DNA IDENTIFICATION OF BIRDSTRIKE REMAINS – PROGRESS REPORT

***Carla J. Dove, Marcy Heacker**, and **Lee Weigt**, Smithsonian Institution, P.O. Box 37012, Washington, DC 20013-7012 USA*

The FAA (William J. Hughes Technical Center), U.S. Air Force, and the Smithsonian Institution signed a five year Interagency Agreement in 2003 to develop a multi-level DNA-based identification method for bird strike remains. The tasks to be achieved include: establishment of a database of mitochondrial DNA sequences (12s, 16s, CytB and COI) for 300 species of birds; testing and refining DNA-based techniques for forensic samples; and development of user-friendly methods of collecting 'snarge'. A separate collaboration between the Smithsonian and the University of Guelph (Canada) began in 2004 to sequence one of these target genes (COI, 'barcode') for all birds of the United States and Canada. This effort is now 93% complete and sequences are available for some 642 species of birds (462 provided by this project). In 2005, 83 bird strike cases (FAA, USAF) were submitted to the DNA lab for identification testing. A variety of material was tested for contamination, sample quantity and quality. The DNA method provided more specific identifications than morphological analyses alone in 66% of these cases. Twenty-one cases lacked viable DNA, but 5 of the non-viable cases contained sufficient feather material for microscopic identifications. Preliminary results show that molecular identifications are not reliable in some species of waterfowl and gulls (species known to hybridize widely) because of significant overlap in mtDNA sequences. Because of limitations in both methods, we recommend using a combination of molecular and morphological techniques for the best bird strike identification system. Testing continues on the use of a 'DNA' card to fix the samples in the field and a rigorous testing protocol is planned for DNA bird strike identifications during the 2006 Fall migration.

(25) ADVISORY CIRCULAR 150/5200-36. QUALIFICATIONS FOR WILDLIFE BIOLOGISTS CONDUCTING WILDLIFE HAZARD ASSESSMENTS AND TRAINING CURRICULUMS FOR AIRPORT PERSONNEL INVOLVED IN CONTROLLING WILDLIFE HAZARDS ON AIRPORTS

***Edward C. Cleary**, Office of Airport Safety and Standards, Federal Aviation Administration, 800 Independence Ave. SW, Washington, DC 20591 USA*

This Advisory Circular (AC) describes the qualifications for wildlife biologists who conduct Wildlife Hazard Assessments for airports certificated under Title 14, Code of Federal Regulations, Part 139 (14 CFR, Part 139). In addition, it addresses the minimum wildlife hazard management curriculum for the initial and recurrent training of airport personnel actively involved in implementing Federal Aviation Administration (FAA) approved Wildlife Hazard Management Plans. Wildlife biologists conducting Wildlife Hazard Assessments or presenting training for airport personnel actively involved in implementing FAA approved Wildlife Hazard Management Plans at certificated airports must have professional training and/or experience in wildlife hazard management at airports [§139.337(c) and (f)(7)]. Airport personnel actively involved in implementing FAA approved Wildlife Hazard Management Plans must receive initial training and, every 12 consecutive months after that, recurrent training [§139.303(c) and (e) (Personnel)].

(26) MEDIA RESPONSE PLANS – THE FORGOTTEN TOOLS

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The Media Response Plan is an essential tool for any wildlife management program's toolbox, and yet, is normally not thought about until after something unpleasant happens and the media are knocking at your door. Developing an effective Media Response Plan is critical to the success of your wildlife management program and provides any manager with the opportunity to be prepared for both proactive and reactive situations when dealing with the media.

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POSTERS

(P1) **METHODOLOGICAL FRAMEWORK TO ASSESS THE RELATIVE THREAT OF BIRD–STRIKES IN COLOMBIAN AIRPORTS**.

Juan David Amaya-Espinel, Sergio Córdoba-Córdoba *and* ***Guillermo Rico-Hernández,*** *Conzooltores Ltda., Calle 114 A No. 41-85 A-201, Bogotá, D.C., Colombia, South America*

The likely risk of a bird-aircraft collision (bird-strike) in a given airport was assessed using a standard methodological evaluation of birds along the runaway to record data and spatial distribution of danger; and making a threat categorization. Contiguous quadrants of 200 X 200 meters were located along the runaway from one head to the other with a center point count at 100 m, in which all birds were recorded for 15 minutes, accounting for species identification, number of individuals (flock size), flight altitude from ground to > 1,000 m, flight direction including number of perpendicular crosses, and behavioral characteristics (flight, roosting, foraging, reproduction and vocalizations as indicative of permanence and territoriality). Environmental data (% cloud cover and weather -sunny, partially sunny, mist or rainy-) was also recorded. The relative threat and likelihood to generate a collision by any bird species was taken as the result of the sum of scores of four criteria (each with three possible values): 1. Range of weight, 2. Relative abundance, 3. Relative crosses and 4. Flock size. Species were categorized as highly dangerous (10 to 12 score points), potentially dangerous and of concern (7 to 9), or of least danger but precautions warranted (< 6) for some species. Threat categorization and spatial distribution for each species allowed assessing areas of bird species concentrations, identification of sites more often crossed and if attracted by artificial or natural areas, as well as time of the day and climatic conditions that did so. Proposal of direct management options, tools and strategies for a bird avoidance program for specific airports is being developed by the Colombian Civil Aviation Agency -Aerocivil to ensure international air safety standards.

(P2) EVALUATION OF BIRD-STRIKE RISK IN TWO COLOMBIAN AIRPORTS: A STANDARD METHODOLOGY TO RANK SPECIES AND PROPOSE MANAGEMENT PRIORITIES

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We conducted avian evaluations at two Colombian airports to assess, through a standard methodology, the risk of bird strikes. Evaluations were conducted at "Aeropuerto Perales" (AP), Department of Tolima, 1030 m a.s.l. Tropical Dry Forest and, "Aeropuerto Palonegro" (APN), Department of Santander, 1188 m a.s.l. Humid Pre-mountain Forest. Forty-seven species of 12 different families, 3,998 individuals were encountered at AP through 1284 records. In contrast, 33 species of 16 families, 1,112 individuals in 396 records were found at APN. The Whispering ibis (*Phimosus infuscatus*) was the most abundant species with more than 50% of all individuals followed by the Black vulture (*Coragyps atratus*) with 18% at AP. The first species represented over 72% of all crosses along most of the runaway, the second 11% crossing in high numbers in some areas. Both species mean flock size was over 5 individuals. Threat categorization showed that this two species are the most highly dangerous for this airport. The Yellow-Hooded blackbird (*Agelaius icterocephalus*), is of high concern but median risk. Awareness for 12 other species is warranted even thou considered of low risk for Aviation procedures at AP. The Black vulture was the only species categorized as highly dangerous at APN, because of its weight and abundance (50% of all individuals) more than 70% cross the runaway and were found in flocks of over 4 mean individuals, but sometimes in huge flocks of over 40. Two other species, the Orange Chinned parakeet (*Brotogeris jugularis*) and the Eared dove (*Zenaida auriculata*), are of main concern and median risk. Five other species are of awareness but low risk following the threat categories at APN. Bird strike evaluation through a standard methodology allows comparing thru ranking priorities the risk, to propose specific and generalized management tools at airports localized in different life zones.

(P3) EMPLOYING BASH AT WESTOVER AIR RESERVE BASE, MASSACHUSETTS

***Major Gary Cooke**, U.S. Air Force, Westover ARB, Flight Safety Officer, 100 Lloyd Ave, Suite 106, Westover ARB, MA 01022 USA*

Westover Air Reserve Base (ARB) in western Massachusetts is home to 17 USAF C-5A Galaxy airlifters. The mammoth C-5, with a 222 foot wingspan and length of 247 feet, is the backbone of the U.S. Air Force airlift fleet. The 2,500-acre base is home to the largest single area of grassland in Massachusetts. The BASH program at Westover focuses mainly on the wildlife risk posed to the C-5, and is administered by the 439th Airlift Wing safety office. Airfield grasslands are host to two state-listed endangered/threatened bird species: the Grasshopper Sparrow and the Upland Sandpiper. To protect our airplanes from wildlife strikes, the Bird Hazard Working Group (BHWG) at Westover ARB works closely with state and federal agencies, including the Massachusetts Division of Wildlife Endangered Species Division, the Fish and Wildlife Service Office of the U.S. Department of the Interior and the Wildlife Services Division of the U.S. Department of Agriculture (USDA). We hold a long-standing contract with the latter which includes the services of a full-time wildlife biologist who does outstanding work implementing key facets of our BASH plan. Interagency coordination of this type is essential to managing the risk. The Westover ARB BASH plan employs a classic risk-management process to deal with this risk from every possible angle. Identifying the hazard, for example, is the first important step. Since 1997, the base has compiled detailed historical data on each species involved in a known or suspected bird strike. The data include bird remains discovered on aircraft, taxiways and runways. All are identified by the Smithsonian Institution. With the use of all available expertise as well as careful analysis of our bird strike data, we focus on mitigating the probability of damaging strikes from larger/denser wildlife, such as flocking waterfowl. These larger flocking species are much more likely to result in damage to aircraft than a collision with smaller grassland species. The latter comprise the great majority of our strikes. Risk assessment in our BASH plan requires continual management, varying with migration patterns, weather, and environmental conditions. The BHWG includes a representative from the Operations Group, responsible for flying the aircraft, to constantly assess the bird strike risk. The BHWG evaluates and implements control measures for their simplicity, cost and effectiveness. An example is our base mowing plan, which is designed to minimize risk to the threatened/endangered species without compromising air safety issues. The BHWG decides on appropriate control

measures and implements them through the BASH plan. This plan is a fluid document which can be quickly changed in response to a new wildlife threat, such as a nearby landfill expansion. Depredation is the last resort and is managed exclusively by our USDA specialist on base. In summary, the Westover Safety Office secures significant input from all responsible and interested agencies, both on and off base. The BHWG enjoys active participation from the commander, the air traffic control facility, aircrew members, the real property manager, the environmental engineer, aircraft maintenance, state/federal agencies, nearby landfill operators and golf course operators. Managing the bird strike risk from every angle has produced excellent, measurable results that have contributed directly to the safe flying environment at Westover ARB.

(P4) REAL BIRDS VERSUS WHIRLY BIRDS: BIRD STRIKES TO CIVIL HELICOPTERS IN THE USA, 1990-2005

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To our knowledge, there has been no published analysis of bird strike data specific to helicopters. Our objective was to conduct a comparative analysis of strike reports involving helicopters and fixed-wing aircraft from the Federal Aviation Administration's Wildlife Strike Database. From 1990-2005, 370 (0.6%) of the 64,734 reported bird strikes to civil aircraft involved helicopters. Of the 370 reported bird strikes involving helicopters, 186 (50%) indicated damage and 67 (18%) indicated substantial damage. In contrast, only 15% of bird strikes with fixed-wing aircraft resulted in damage and 4% resulted in substantial damage. Whereas helicopters accounted for only 0.6% of all bird strikes, helicopters accounted for 13% (2) of the 16 aircraft destroyed and 24% (34) of the 141 injuries caused by bird strikes. For helicopters, 63% of bird strikes and 77% of damaging strikes occurred during the en-route phase of flight compared to only 2% and 7%, respectively, for fixed-wing aircraft. The much higher en-route strike rate for helicopters is related to the lower height at which helicopters typically fly compared to fixed-wing aircraft. For helicopters, about 52% of strikes occurred from 501-2,000 feet AGL compared to 14% for fixed-wing aircraft. This is a height zone frequently used by many bird species, especially gulls, waterfowl, raptors and vultures, the species most commonly struck by helicopters. For helicopters, 97% of strikes causing damage occurred at an indicated airspeed of more than 60 knots. Windshields represented 41% of helicopter components reported as damaged by bird strikes compared to only 6% for fixed-wing aircraft. The disproportionate number of windshields damaged and resulting human injuries indicates that improvements are needed in windshield design and strength for helicopters.

(P5) CANADA GOOSE POPULATIONS AND STRIKES WITH CIVIL AIRCRAFT: POSITIVE TRENDS FOR AVIATION INDUSTRY

***Richard A. Dolbeer**, USDA, Wildlife Services, 6100 Columbus Ave., Sandusky, OH 44870 USA; **John L. Seubert,** 1800 Zinnia Street, Golden, CO 80401 USA*

Canada goose (*Branta canadensis*) populations in North America are subdivided into "migrant-goose" and "large-goose" populations. The "large-goose" populations consist primarily of flocks that are non-migratory (hereafter referred to as resident geese). Estimated migrant and resident geese numbers in the four flyways (Atlantic, Mississippi, Central, and Pacific) are based on mid-winter or breeding period counts. The overall Canada goose population increased five fold from 1970 (1.08 million) to 2005 (5.01 million). Most of this overall increase was due to a 15-fold increase in the population of resident geese (from 0.2 to 3.4 million), especially during the 1990s when the population increased at a mean annual rate of 13.8%. Since 2000, the resident Canada goose population has stabilized at about 3.4-3.6 million. The migrant population has remained relatively stable since 1990 with the population in 2005 estimated at 1.7 million. Resident geese comprised 67% of the total Canada goose population in 2005 compared to 38% in 1990 and only 18% in 1970. Resident Canada geese are of particular concern to aviation because of their large size, flocking behavior, use of airports for grazing, and year-round presence in urban environments. From 1990 to 2005, 1,279 Canada goose and "goose" (unidentified to species but likely Canada geese) strikes with civil aircraft were reported in the USA of which 675 (53%) caused damage. Damage to one or more engines was reported in 163 cases. The number of reported Canada goose and "goose" strikes per year increased, in concert with the increase in the resident population, from 39 in 1990 to 115 in 1998. However, reported strikes declined since 1998 to 70 in 2005 in spite of the continued high overall resident population. This decline is likely due to aggressive Canada goose management programs implemented at many airports and other urban areas. These programs must be continued and expanded to reduce this significant hazard to aviation.

(P6) AVIAN INFLUENZA: WHAT FIELD BIOLOGISTS SHOULD KNOW

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Because field biologists, airfield personnel, and those involved in bird strike prevention often handle blood and other tissue of avian origin, they need to understand the means of transmission and know effective ways to protect themselves and those that will be examining the remains for identification purposes. This poster will present up-to-date information on the HPAI H5N1 (Avian Flu) virus and provide details of how to safely handle bird remains. A list of websites and other information regarding safe handling of bird strike remains is provided.

(P7) DEVELOPING A RISK RATING SYSTEM FOR BIRD STRIKE OCCURRENCES

Albert Froneman *– Airports Company South Africa – Endangered Wildlife Trust Strategic Partnership. Private Bag X11, Parkview, 2122 South Africa*

Bird strike reporting is becoming increasingly important as airport operators, airlines and government aviation authorities are requesting their staff to report all bird strike occurrences. In South Africa the Endangered Wildlife Trust has been managing an integrated bird and wildlife hazard management program at ten airports managed by the Airports Company South Africa for the past seven years. In an attempt to best understand the bird strike hazard at the various airports a bird strike definition has been adopted which includes the reporting of carcass remain retrieved from the runways through to the more serious incidents where damage was reported to the aircraft. Numerous occurrences have been reported at the airports during this period – several of which only involved carcass remains or strikes with small birds having no effect on the aircraft. In response to requests from both the airport authorities and local airlines a system has been developed to rate bird strike occurrences based on their severity and in so doing provide more meaningful statistical feedback to the airport and airline management. The approach taken involve using factors such as known high risk bird species occurring at the airport, whether or not damage was done to the aircraft etc. to rate all the bird strikes which occurred at the respective airport. This paper will explain in detail the approach taken to rate the severity and risk of bird strike occurrences at airports and in so doing provide more meaningful statistical feedback to decision makers.

(P8) BAT STRIKES: PAST, PRESENT, AND FUTURE

***Suzanne C. Peurach**, USGS Patuxent Wildlife Research Center, Smithsonian Institution, Division of Mammals, National Museum of Natural History, Washington DC 20560 USA*

All but a few North American bats are insectivorous and weigh less than 35 g, but this diverse group of mammals also contains species with wingspans up to 2 meters and weighing a kg or more. Even small-bodied bats can cause considerable damage when encountered in swarms. When aircraft head into new territory and encounter strikes, the ability to identify the species of bat struck is paramount to preventing future strikes. Identifications of bats from fragmentary evidence are made by comparing samples recovered from aircraft with specimens housed in the Smithsonian Institution's National Museum of Natural History. This collection, worldwide in scope, is the largest collection of mammal specimens in existence. The species of bat most frequently identified in U.S. Air Force aircraft strikes is the Brazilian free-tailed bat, *Tadarida brasiliensis* (38%). Tree bats, which include the red bat, *Lasiurus borealis* (19%), Seminole bat, *L. seminolus* (7%), and hoary bat, *L. cinereus* (13%), along with strikes identified only to the genus level, collectively comprise 44% of identified bat strikes. The information obtained from these identifications has already greatly enhanced our understanding of when and where bats are flying. The data associated with these aircraft strikes in respect to date, time, location, and altitude of flight may also provide important insights for other projects, such as the development of wind energy resources.

(P9) DNA IDENTIFICATION OF BIRD STRIKE REMAINS – PROCEDURES AND TECHNICAL CONSIDERATIONS.

***Nancy Rotzel**, Genetics Specialist, Feather Identification Lab, Smithsonian Institution, P.O. Box 37012, Washington DC 20013-7012 USA*

This poster presents the development of DNA techniques by the Smithsonian Institution Feather Lab to identify bird remains recovered from military and civil bird aircraft collisions (bird strikes). The following steps for molecular identification of forensic samples are explained: receipt of sample, extraction, amplification, sequencing, and final data analysis using computer software. Recommendations for collecting bird strike samples for DNA analysis are also discussed. This work compliments the continuing work of the Feather Lab by providing a molecular signature to verify bird strike samples that do not contain sufficient feather remains for morphological identification.

(P10) THE VECTORIAL 3D BIRD FLIGHT MONITORING SYSTEM: A NEW TOOL TO TRACK AND MANAGE BIRDS ON AIRPORTS

***Raoul Tomassi**, Tomassi and Tomassi America, Alexandria, VA USA and SCT, Udine, Italy*

Among the many sensors available to detect and track bird movement on airports, few provide a satisfactory capacity to both monitor bird flight and the capability to rapidly review, update, and improve monitoring capabilities. The Vectorial Three Dimension Bird Flight (V3DBF) Monitoring System has been developed to provide detection and analysis of bird movement using digital images and advanced image analysis technology. The sensor system is capable of identifying bird targets and using geometric relationships between sensors and the targets to identify the range and altitude of birds. The rapid refresh rate of the system allows horizontal and vertical tracking of bird targets. Detection algorithms can be automatically updated for species present and system output provides movement tracks in relation to geographic features such as runways. It is also possible to integrate system detection tracks with GIS. Because the digital images are retained, a complete record of detection and corresponding data processing is available to check accuracy and evaluate the performance of the system in a given airport setting. The present system operates using two sensors, but can be expanded to provide multiple sensors and coverage of large areas. Present V3DBF system capabilities have been expanded beyond detection and tracking to include bird strike hazard assessment and hazard warning based on track intersection with critical airspace.

(P11) **BIRD CLASSIFICATION IN NOISY ENVIRONMENTS: THEORY, RESULTS AND COMPARATIVE STUDIES**

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Bird classification plays an important role in minimizing collisions between birds and aircraft. It is a challenging task to perform the sound-based classification correctly in a noisy environment. This paper addresses robust techniques that can improve the classification of bird in noisy environments. A complete recognition system is described and evaluated on a bird sound database containing 1547 bird sound files, with 11 bird species. Two types of features were extracted from the sound files: Mel Frequency Cepstral Coefficient (Mfcc) and RelAtive SpecTrAl (RASTA). Also, two statistical classifiers were developed using Gaussian Mixture Models (GMM) and Hidden Markov Models (HMM), respectively. The performance of these features and models are compared. Very good recognition rates (97% for clean data and 92% for 5dB signal-to-noise ratios) have been achieved when proper feature and model were selected.

(P12) NICARBAZIN: AN AVIAN REPRODUCTIVE INHIBITOR FOR PIGEONS AND GEESE

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Nicarbazin (NCZ) is an anticoccidial drug routinely used in the poultry industry. When fed to laying hens, NCZ impacts reproduction by either reducing hatchability of eggs or reducing rate of egg laying. Initial laboratory tests were conducted with mallards (*Anas platyrhynchos*) to determine the efficacy of NCZ as a waterfowl contraceptive. Hatchability was 26% for mallards fed 34 mg NCZ/kg body weight (500 ppm in feed) for 14 days compared to 55% for control mallards. Based on these results, two field studies, one each in Oregon and Colorado, were conducted with Canada geese (*Branta canadensis*), which showed a 50-56% decrease in hatchability when OvoControl G was fed during the breeding season. In November 2004, OvoControl G (2500 ppm) was registered with the Environmental Protection Agency as a reproductive inhibitor for resident Canada geese. In 2005-2006, a nesting study with 11 pairs of captive pigeons (*Columba livia*) evaluated the effectiveness of OvoControl P (5000 ppm NCZ) in reducing egg hatchability. During the pre-treatment phase, birds had unlimited access to normal maintenance diet and each female produced 2 eggs, all of which hatched and developed normally. The number of eggs produced during the treatment phase, when birds had daily access to OvoControl bait, did not differ from the number of eggs produced during the pre-treatment phase, but the number of nestlings decreased 59% to 9 chicks. Furthermore, 91% of the pairs experienced reduced egg hatchability. Productivity in the recovery phase returned close to pretreatment levels as 21 eggs were laid and 18 viable nestlings were produced. These findings demonstrate that OvoControl can reduce pigeon productivity and that pigeons will return to normal following withdrawal of OvoControl. The effect of OvoControl is dependent on the daily consumption of treated bait. Therefore, field application must ensure consistent daily exposure to the target population.